Tuberculosis in Cows.—How Prevented.

By Dr. J. F. Roub, Monroe, Wis., at the Convention of the Southern Wisconsin Cheesemaker’s Association, February 16—17, 1905.

Tuberculosis, consumption and infectious diseases common to man and a large number of animals, caused by the bacillus tuberculosis and characterized by a productive inflammation, giving rise to small rounded bodies (tubercles), or diffuse infiltration, with a tendency to necrotic degeneration and caseation; or to fibroid degeneration, calcification or ulceration. Reptiles, fishes, birds and some mammals do not readily contract the disease under normal conditions, yet under abnormal and debilitating conditions nearly all will succumb to it. Tuberculosis of the barnyard fowl is not readily interchangeable with the varieties effecting the mammal, yet, with a special predisposition, it can be transferred and can then be conveyed from animal to animal in the new genus in which it has been implanted. That of cage birds is interchangeable with that of man. Guinea pigs have a strong susceptibility to tuberculosis,
whether from human or bovine source, and rabbits for that of birds; the guinea pig, therefore, has been especially availed of for the experimental transmission of tuberculosis, and as the disease in them becomes acute and rapid in its progress, these subjects permit the multiplying of experiments in a short period. Rabbits are less vulnerable to the bovine or human form. Sheep and goats kept under usual conditions show a remarkable immunity from tuberculosis, yet if directly inoculated, susceptibility is easily shown.

The horse, ass and mule rarely contract tuberculosis, yet in the horse, autopsys have revealed to me several nicely and well developed cases of pulmonary tuberculosis. Cattle, the bovine race, are remarkably subject to tuberculosis. This is probably due in part to the great amount of connective tissue, lymph plexus in the lungs and elsewhere. The habit of using the mouth in hurried breathing, the deep, sudden inspiration through the mouth and over the tonsils that follows a cough; restricted size of the cow stables, lack of room, no ventilation, bad drainage, no light, the habit of feeding from the same trough with cattle adjacent, the great strain of breeding immature heifers (or yearlings), and too much inbreeding, has a tendency to degenerate; heavy milkers, the retention in the herd of fail-
ing cows for their milk product, and high priced offspring. In dairy cows of milking breeds the drain on the system is liable to prove too great under a ration for milk, warm sloppy mash of grain, bran middlings, roots, silage, saccharine roots, warm drinking water, a warm atmosphere, liberal salting and enforced idleness in the stall, the dairy cows suffer, as the greater the yield the more the system is robbed of the adipose material which is so needful to a vigorous health. When the cow has been reduced to a high pressure milk factory, her physical size reduced to obviate the need of a large sustaining ration, and her milking capacity stimulated to the highest degree, the presence of the tubercle bacillus is especially dangerous. Insufficient and indigestible or innutritious food contribute to debility and lessen the power of resistance.

In common with all infectious diseases, tuberculosis owes its great extensions to the sale and purchase of animals where an indigenous race of cattle is raised and sold without any additions from without. Tuberculosis is usually rare and confined to the one herd, or to those having intimate intercommunication with it; where, on the other hand, a large stock is kept up, as in milk dairies, and few or no calves are raised, but the bulk of the cows are sold off yearly and replaced by new purchases, tuber-
culosis sooner or later finds admittance through the body of an infected animal, and once implanted in the herd it goes on increasing without limitation, except by the sale or death of the more seriously affected. The larger the herd and the greater the number of yearly changes, the greater the number of opportunities for the introduction of an infecting animal. Where a great part of the herd is turned off yearly, and new animals are drawn from any and every source indiscriminately, it would border in the miraculous if such a herd were to remain free from the infection for any great length of time. The recent extension of tuberculosis in herds has been coincident with the great development of commerce in live stock, and the rapid transit on land and water by steam. Before the days of the steam engine, animal plagues advanced slowly, excepting in the presence of a great European war, which drew animals from all available sources, congregating them in large, mutually infecting droves (in commissariat parks), and marching them in the wake of the army for its daily supply. Inevitably every country invaded was infected, and the plagues, like "Rinderpest" and lung plague, were the first to appear, and in this lay a certain measure of palliation of the evil, as the exposed and often weaker animals were killed off so that the slower contagion, like
that of tuberculosis had not time to develope, but since the modern expansion of dairy husbandry have combined to increase and concentrate the cattle industry in ratio with the manufacturing and commercial progress of the nations, and as the live stock are kept under a milk stimulating state, life passed largely indoors, the way has been open for an ever advancing increasing of tuberculosis. In the United States the centralization of population in the eastern states and in all the great centers of industry, and the concentration of cows for the milk supply, and within our own locality, connection with butter and cheese factories have contributed to wide and local extensions of consumption, consequently it has been no uncommon thing to find herds in the vicinity of cities with twenty to one hundred per cent. affected, in striking contrast with the two or three per cent. found in the fat cattle from the plains.

Time not permitting to go into all the minor details, I will outline the organs affected. Pulmonary tuberculosis, or as you might understand it, consumption of the lungs, one of the most frequent seats of tuberculosis, a noticeable feature in the tuberculous lung is the great frequency of tubercles, of all different ages, from the initial transparent nodule to the caseated or calcified mass, side by side, studed over the surface of the lungs. The pleura often
suffer by continuity of tissue from the diseased lung. They may be affected primarily through infection of the circulating blood; the earliest pleural lesions may be congestion, exudation and the foundation of false membranes, but soon become the seat of tubercles. The bronchial and mediastinal lymph glands receiving as they do the different trunks from the lungs and pleura offer in their sluggish currents the most favorable culture vessels, they are found to be tuberculous. When the tissues they drain appear to be sound, we must conclude that the slight lesions in the latter have recovered, or that the bacilli have passed through the tissues and lymph channels without establishing any center of disease, pericardial and cardiac lesions. Pertaining to the heart and its coverings the pericardium may be implicated from the pleura or independently, though tuberculosis of the the heart is rare, it may be the seat of primary tuberculosis, or of extension from the pericardium or endocardium. I have found but three cases of tuberculosis of the heart.

LIVER TUBERCULOSIS.

The liver is greatly exposed to tuberculosis, as the single destination of all the blood from the gastro-intestinal tract. I have found tubercle in the liver various sizes from a pin head up to six or eight inches in diameter.
The spleen and pancreas are liable to infection, the former more likely to become affected than the latter.

**GENITO URINARY TUBERCLES.**

The kidneys are always liable to suffer in generalized tuberculosis, their function being to eliminate the great quantity of blood that passes through them. The tubercles may be numerous, the infection extends along the glandular tissue producing congestion and nephritis. None of the internal organs are immune.

**TUBERCLE OF THE UDDER.**

From the vascularity of the udder it is exposed to infection whenever the bacilli enter the circulation. It may also be directly infected by the entrance through the teat or a tranma of the bacillus of the stable dust. There may be for a time only a slight swelling, which leads to no suspicion on the part of the milker, and as the secretion is not arrested, a dangerous product may be distributed. At this stage the lobules on section appear swollen, gray with yellowish points, and minute hemorrhage; in other cases, usually more advanced, the gland is hard, nodular, enlarged and shows a marked thickening of the walls of the smaller milk ducts. The gland is often greatly enlarged, the milk suppressed or completely altered, and tubercular neoplasms or ulcers exist in the larger ducts.
TUBERCULOSIS OF THE BONES.

Although not as frequent as of the internal organs, I have found in my practice some dozen cases. It usually attacks the spongy tissue near the articular extremities, giving rise to considerable exudate thickening of the bone and arthritis. No organs in the body suffer more than the lymph glands as they receive through their afferent trunks and develop the bacilli coming from any adjacent tissue to which they are subsidiary. There is also evidence to show that bacilli entering from the lungs or bowels may pass through these with apparent effect to develop in the connected lymph glands. The vitality of bacillus tuberculosis is strong but variable. In sterilized water at 46° to 64° F. the human bacillus survived for fifty to seventy days (Chatemesse and Vidal), the bovine indefinitely (Gallier), and the avain bacillus at a higher temperature one hundred and seventeen days (Straus and Debarry). In dried expectoration the bacillus of man still infects after nine or ten months (Koch, Schill, Fisher). In infected cows, lung dried and pulverized, it infected guinea pigs at one hundred and two days. When Sputum is mixed in soil it may survive one hundred thirty seven days (Feltz). X-rays do not arrest the growth of cultures (Blake, Pott, Ausset). A dry temperature of 212° F. for an hour left
some of the bacilli still infecting to guinea pigs (Lartigan). A moist heat of 140° F. for one hour sterilizes (Man Smith), the scum on milk may still prove infecting. Half an hour of a moist temperature of 212° F. is sterilizing, yet in the case of steaks, roasts and boiled meats the size of piece often prevents the reaching of this temperature throughout, and it becomes unsafe to use any meat in which the redness of the juice shows, that the albumen has not all been fully coagulated. A freezing temperature 16° to 26° F. does not devitalize the bacilli, even when alternated with thawing at intervals for several weeks (Saltier, Cadeac and Malet). Heavy salting of meats has been thought to kill the bacillus in a month. After fifteen days in salt the microbe failed to kill rabbits, but still killed the guinea pig; after thirty days it killed neither (Galtier).

CASES OF DIRECT INFECTION FROM MAN TO OX, AND FROM OX TO MAN.

Chauveau induced tuberculosis in cattle by feeding the tubercle from the lungs of man.

Bollinger inoculated a three-months calf with liquid from human tubercle and killed it seven months later. Fibroid pedunculated tumors, from a pea to a walnut in size, hung from the mesentery and spleen, and the mesenteric and retroperitoneal glands were tubercular.
Sidney Martin furnishes the following: Four calves were fed 70 c. c. of sputum containing a large number of bacilli. Three were killed after four, eight and twelve months respectively, and had severally 53, 63 and 13 nodules on the small intestine, mostly on Peyer's patches. The calves received at one dose 440 c. c. of tuberculous sputum, and were severally killed after eight and nineteen weeks. The first had tubercular nodules in the intestine and mesentric glands.

Thebald Smith inoculated sputum into the chest and abdomen of the following:

A yearling heifer, which was killed two months later and showed on the pleura near the seat of infection a mass of tubercles, one by one and a half inch in diameter, with partly caseated centers; also a nodule one-eighth of an inch on the right lung, and small tubercles attached to the diaphragm and omentum.

A yearling injected in the same way showed in two months on the diaphragm a mass of tubercles two inches in diameter, and a second mass one inch in diameter on the ribs near the seat of infection. Microscopical examination failed to detect bacilli, but there is no evidence that they were sought by culture or inoculation.

A cow injected in the chest and killed after two
months showed tubercles of the lungs, pleura, and mediastinal glands, partly caseated and containing bacilli. Vascular fringes hung from the pleura.

A cow receiving a chest injection of sputum culture and killed in two months showed fringes and pendulous masses on the pleura with small tubercles containing cheesy matter and a few bacilli.

Dr. Demme, of the Children's Hospital, Berne, had four infants, the offspring of sound parents, with no hereditary taint of tubercle, die of intestinal and mesenteric tuberculosis, having been fed on the milk of tuberculous cows. Among 2000 tuberculous infants treated in twenty years, these were the only ones in which he could exclude the probability of hereditary and other causes.

The four-year-old son of Colonel Beecher of Yonkers, died March 1894, of tubercular meningitis, and the two Alderney cows which had supplied him with milk were then proved consumptive by the tuberculin test and post mortem examination.

A. H. Rose, of Littleton, Mass., gives the case of a child which was fed for three years on the milk of a tuberculous cow and died with abdominal tuberculosis (Ernst).

Andersen, of Seeland, reports the death from tuberculosis of a six-months-old child which had fed on the milk
of a cow having tuberculosis of the udder. The mother developed symptoms of tuberculosis after the death of the child.

Dr. Gosse, of Geneva, Switzerland, spent his Sundays with his family on an estate in the hills, and his daughter, aged seventeen years, took great pleasure in drinking milk, warm from the cows. Early in 1893 she sickened with an obscure illness, and after ten months died, revealing at the necropsy intestinal and mesenteric tuberculosis. The five cows on the estate were tested with tuberculin; four reacted and were killed; two showed tuberculous udders. (Nocard).

Dr. H. M. Pond reports four cases of tuberculosis in one family, three of them fatal. The cows supplying the family with milk were tuberculous.

Dr. Faust, veterinarian, of Poughkeepsie, records the case of a family on Long Island that lost from tuberculosis 139 cows. A three-year-old child and two grown sons died of tuberculosis. Tuberculosis was unknown in the parents' families.

Dr. Cooper, veterinarian, Paterson, N. J., furnishes this: A child, fed on the milk of a cow, contracted tabes mesenterica. Examination revealed the presence of tubercle bacilli in the milk. The milk was then fed to ten kit-
tens, all of which became ill and emaciated, and when killed showed tuberculosis.

A dairy of common cows had seventeen out of twenty-six destroyed for tuberculosis, and the farmer’s wife, father-in-law, and two brothers-in-law had shortly before died of consumption. The wife felt ill in the close house air, and with her father occupied herself much about the cattle.

Stalker and Niles report that 5 persons, 20 to 30 years of age, of healthy ancestry, died of tuberculosis within two years, on a farm where 17 tuberculous cattle were found, and others had died in previous years. (Bull, Ia. Agr. Exp. Station, 29).

A peasant at Silkeborg drank freely of milk freshly drawn. He died of tuberculosis, as did also a cow, and later in the same stable, a pig.

A peasant had an 11 year old cow with generalized tuberculosis implicating the udder. The wife of the peasant, formerly healthy, became tuberculous shortly after the udder became affected and died at 45. A daughter who, like her mother, used the milk of this cow, died consumptive in the same year. The husband who drank beer, and not milk, remained well.

A physician fed his two children on the milk of his tubercular cow, and lost both from tuberculosis. Neither
parents nor grand-parents were tuberculous. (L. Pearson in Bull. 75, Tuberculosis of Cattle).

There is only one way to eradicate tuberculosis from the dairy herds, and that is by the tuberculin test. Tuberculin is the bouillon in which the tubercle bacillus has been grown, charged with the toxic products of its growth, but which has been raised to a boiling temperature to destroy all germ life, and from which the dead germs have been removed by passing it through a porcelain filter. In making the test I usually take the temperature every two hours for six hours, then injecting under the skin from two to two and one-half c. c. of tuberculin, from nine to ten hours after injecting we continue with the temperature, and if the animal shows a rise of two degrees or more, then condemn, and isolate all infected cattle and take precaution of other infection.

As I understand, this meeting is for the advancement of the dairy industry.—Very good.

You want wholesome, pure, clean cheese, trying to bring the cheese up to a higher standard. You have made provisions for an inspector to inspect all factories on the line of sanitation; you want the cheeser to put his factory in a sanitary condition, quite necessary that it should be so, but stop and consider, is this sanitary factory and the
cheesemaker that has complied with the law not worthy of sanitary milk? We will see what kind of milk you are putting into these factories. Contaminated by actual contact and absorption, gargety, pyaemia, infectious, eight per cent. of cows retain the afterbirth, the osuteri becomes constricted, and often one to two gallons of pus retained in the uterous. What becomes of it? Absorbed and taken up into the circulation, the cow becomes debilitated, and if she does not die, she is a mere skeleton the remainder of factory season. In regard to milking, I have seen milkers diping their hands in the milk, finish milking a cow, and probably find the next cow lying down, and in rising would find the whole udder covered with the offal or manure. What is the result? The milker wets his hands, strips manure, milk and all into the pail. I have mentioned it to parties, the answer was, "O, it all goes!" You need an inspector, but more for the patrons of factories than for the cheesemaker and his factory. Let your inspector go and see that your barns are put in a good sanitary condition, and that you get good, clean, wholesome milk, and isolate all diseased cows, no matter from what the infection may be, and especially when infected with tuberculosis of the udder or otherwise.